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COLLEGE OF NATURAL RESOURCES BERKELEY CAMPUS and
THE DIVISION OF AGRICULTURE AND NATURAL RESOURCES

Research

Canopy Measurement Workshop Participants

We received instruction and practice in the use of the sighting tube, spherical densiometer, and Solar Pathfinder. We also reviewed aerial photo interpretation of cover and were introduced to the Dynamax, a photographic and computer-program method for determining cover. A card depicting cover as various aggregations of black dots on a white circular field was also used to calibrate our eye to different % covers. Tree crowns tend to be more clumped or grouped than shown on this card however, so a better guide might be developed by actually taking vertical pictures of crowns that might be seen from an observer looking up (I believe the angle covered by a 50 mm lens for a 35 mm camera is the same as our visual field).

It is clear both from the written descriptions of the instruments and the discussion among participants that these devices measure different aspects of the forest canopy and therefore do not produce comparable estimates.

It was generally acknowledged that proper training and practice with these instruments is necessary to produce consistent, reproducible measurements.

The Solar Pathfinder is used to determine shading of streamcourses. It is the most appropriate tool to address water temperature issues. Questions arose as to the appropriate month to use. The time most critical for the organisms is during low flows and/or critical times in the life cycle of the fish. July or August were deemed most appropriate for Sierra Nevada forests and coastal streams with anadromous fish. The appropriate location for the instrument was discussed - in the middle of the streamcourse or in the thalweg? The general consensus was that the middle of the stream is the most appropriate location. Sampling stations should generally be located 40 to 100 feet apart. Discussion of the need to consider the effect of changes in canopy cover on water temperature at a landscape scale, not simply as a change in cover at one point increasing or decreasing temperature incrementally.

The sighting tube has been selected by CDF as the tool for enforcing canopy rule language because it has a well defined population (i.e. provides an unbiased estimate of vertical canopy cover) which can be sampled and statistically analyzed. The sighting tube can also distinguish between understory and overstory cover, once understory and overstory are defined (see discussion below). It was noted that aerial photo interpretation represents our tie to historical research which correlated wildlife habitat and ecological functions to cover classes. Aerial photo interpretation is accurate enough to classify cover into the Wildlife Habitat Relationships (WHR) classes of 10-24 %, 25-39 %, 40 - 59%, and > 60%, but probably cannot discern 5 to 10% differences in cover.

The spherical densiometer is problematic because it tends to over estimate cover in the 30 to 70 % cover range. Several references in the literature state that samples collected do not produce unbiased

estimates of cover. Some people indicated that they could get consistent results within 5%, while others experienced differences of 15 - 20 %. In most cases, the spherical densiometer has been found to overestimate vertical canopy cover.

To partially correct for this overestimate, a number of people have used the Strickler (1959) method of using only 17 intersections of the densiometer mirror-grid. Taping off the SE and SW sectors of the mirror (N at top of mirror) reduces the measurement of trees/plants in the mid to distant foreground which introduce the most bias, concentrating the measurement on the trees/plants more overhead and thus more representative of cover.

The presentations and our use of these instruments raised a number of questions:

1. What is understory vs overstory? Some workshop participants use silvicultural concepts of dominant, co-dominant, intermediate, and suppressed trees to determine understory; a determination based on the relative position in the canopy rather than an absolute height. The distinction between understory and overstory appears dependent upon the reason why one wants to distinguish between these types of cover. Some people were interested in the understory because of its function as cover and shade, while others were interested in understory because it represented the future forest. The reason for wanting understory measurements may influence what is to be considered understory. The Forest Practice Rules only define understory as generally trees and woody species growing under an overstory.
2. How should incompletely or "lace-ily" covered densiometer squares or Solar Pathfinder segments be handled? Some mentally gather the sparse cover into a dense, complete-cover area and count that. The Dynamax system has the operator adjust the image contrast to make the distinction between cover and open.
3. Because these instruments measure different aspects of the canopy, we should determine what ecological functions or characteristics we are interested in or concerned about and then select the appropriate instrument and measurement. We might have to take more than one type of measurement to address multiple functions. A suggestion was made that reference condition sites representing desired conditions be selected and measured using these and other instruments to establish guidelines or ranges of suitable conditions for cover, shade, and other characteristics.

At Millseat Creek following harvest forest canopy was estimated within the WLPZ, measurements were collected at 37.5' from the watercourse edge and in mid-stream, the transects we used in the workshop field exercise. The results were as follows: 50% vertical canopy cover in the WLPZ (sighting tube) , 82% shade cover in the WLPZ (solar pathfinder/spherical densiometer) and 93% shade cover in mid-stream (solar pathfinder/spherical densiometer). At Millseat Creek 50% vertical canopy cover provided 82% shade in the WLPZ and 93% shade mid-stream. Because forest canopy instruments measure different aspects of the canopy the estimated values reported contribute to confusion about what the 'real' canopy condition is and what effects management practices will have upon the WLPZ. Careful reporting of forest canopy estimates is necessary so that the public, landowners, and other agency folks are not confused.



4. Though this workshop focused on canopy cover measurement, we should keep in mind that wildlife are affected by more than cover or shading. Cover and shade are important but only two elements of wildlife habitat condition. Therefore, we should not try to infer too much from canopy cover measurements alone.
5. Ecological conditions in the coastal forests are different than in the interior forests (although measurement techniques remain similar). e.g. alder and hardwood component of coastal riparian areas are not a problem while they may be dropping out of interior forest riparian areas due to lack of disturbance and regeneration. A suggestion was made to conduct another canopy workshop in a coastal forest. Tim Lewis volunteered to host

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Canopy Measurements Workshop: Results

Transects were run in the WLPZ, along the bank, and in the middle of Millseat Creek. Solar Pathfinder and spherical densiometer readings were taken at 10 points one chain apart. Sighting tube measurements were taken in an Upper Eastside forest area from point 7 to 10, and results might be compared with those points.

Mid Creek SolarP

Mid Creek Densi	Upper East Bank SolarP	Upper East Bank Densi	Upper East WLPZ SolarP	Upper East WLPZ Densi					
94	87	96	93	88	89		81	67	63
96	85	83	89	84	84		88	25	6
93	58	66	82	97	95	55	88	88	63
63	70	100	95	94	96	88	88	69	51
85	87	98	95	90	92	94	87	88	63
75	88	88	96	89	90		97	42	55
72	50	90	91			83	94	86	75
84	86	96					78	57	31
92	92					81	93	42	32
-	-						81	94	78
Avg. 84	Avg. 78	Avg. 90	Avg. 92	Avg. 91	Avg. 91	Avg. 80	Avg. 88	Avg. 66	Avg. 52

Lower West WLPZ SolarP	Lower West WLPZ Densi	Lower West Bank SolarP	Lower West Bank Densi	Lower Mid Creek SolarP	Lower Mid Creek Densi	Sighting Tube Upper E Over story	Sighting Tube Upper E Under story	Sighting Tube Upper E Total Cover
77	50	93	85	60	66	45	46	70
93	91			68	80	48	26	-
70	74	95	78	90	85	44	25	-
81	10	90	79			30	44	60
83	72	90	95			43	30	59
Avg. 81	Avg. 59	Avg. 92	Avg. 84	Avg. 73	Avg. 77	46	27	-
						-	-	71

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Canopy Measurement Workshop

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